**Кулиса. Уравнение Лагранжа**

Кулисный механизм расположен в вертикальной плоскости и состоит из одиннородных цилиндров, блоков (радиус инерции \( i_k \)), штока и груза. Используя уравнение Лагранжа 2-го рода, получить уравнение движения механизма. Найти значение углового ускорения \( \dot{\varphi}_1 \) при \( t = 0 \). Кинетическую энергию представить в форме \( T = (\dot{\varphi}^2/2)(A + B \sin^2 \varphi) \) или \( T = (\dot{\varphi}^2/2)(A + B \cos^2 \varphi) \) (варианты помечены *)


| Задача D31.1. | \( M_{D_1} = M_0 - k\omega_1, \ M_{n_z} = -\mu\omega_4, \)  
| | \( F_{n_z} = -\nu v_{n_z}, \ \varphi_{1,0} = 1.5, \ \omega_{1,z,0} = 0.5\frac{1}{\text{c}}, \)  
| | \( M_0 = 14 \text{ Нм}, \ k = 14 \text{ Нмс}, \)  
| | \( \nu = 8\text{kНc/м}, \ \mu = 11 \text{ Нмс}, \)  
| | \( I_1 = 23 \text{ кгм}, \ m_2 = 18 \text{ кг}, \ m_3 = 36 \text{ кг}, \)  
| | \( m_4 = 28 \text{ кг}, \ R_1 = 38 \text{ см}, \ r_1 = 27 \text{ см}, \)  
| | \( R_3 = 28 \text{ см}, \ R_4 = 20 \text{ см}, \ r_4 = 12 \text{ см}, \ i_4 = 17 \text{ см}. \) |

| Задача D31.2. | \( M_{D_z} = M_0 - k\omega_3, \ M_{n_z} = -\mu\omega_4, \)  
| | \( F_{n_z} = -\nu v_{n_z}, \ \varphi_{1,0} = 1.2, \ \omega_{1,z,0} = 0.4\frac{1}{\text{c}}, \)  
| | \( M_0 = 8 \text{ Нм}, \ k = 14 \text{ Нмс}, \)  
| | \( \nu = 50\text{kНc/м}, \ \mu = 13 \text{ Нмс}, \)  
| | \( I_1 = 5 \text{ кгм}, \ m_2 = 15 \text{ кг}, \ m_3 = 33 \text{ кг}, \)  
| | \( m_4 = 25 \text{ кг}, \ R_1 = 37 \text{ см}, \ r_1 = 26 \text{ см}, \)  
| | \( R_3 = 27 \text{ см}, \ R_4 = 20 \text{ см}, \ r_4 = 12 \text{ см}, \ i_4 = 14 \text{ см}. \) |

| Задача D31.3. | \( M_{D_z} = M_0 - k\omega_3, \ M_{n_z} = -\mu\omega_4, \)  
| | \( F_{n_z} = -\nu v_{n_z}, \ \varphi_{1,0} = 1.1, \ \omega_{1,z,0} = 0.4\frac{1}{\text{c}}, \)  
| | \( M_0 = 7 \text{ Нм}, \ k = 14 \text{ Нмс}, \)  
| | \( \nu = 30\text{kНc/м}, \ \mu = 15 \text{ Нмс}, \)  
| | \( I_1 = 4 \text{ кгм}, \ m_2 = 14 \text{ кг}, \ m_3 = 32 \text{ кг}, \)  
| | \( m_4 = 24 \text{ кг}, \ R_1 = 37 \text{ см}, \ r_1 = 26 \text{ см}, \)  
| | \( R_3 = 27 \text{ см}, \ R_4 = 20 \text{ см}, \ r_4 = 12 \text{ см}, \ i_4 = 13 \text{ см}. \) |

| Задача D31.4. | \( M_{D_z} = M_0 - k\omega_3, \ M_{n_z} = -\mu\omega_4, \)  
| | \( F_{n_z} = -\nu v_{n_z}, \ \varphi_{1,0} = 1.3, \ \omega_{1,z,0} = 0.3\frac{1}{\text{c}}, \)  
| | \( M_0 = 10 \text{ Нм}, \ k = 13 \text{ Нмс}, \)  
| | \( \nu = 8\text{kНc/м}, \ \mu = 12 \text{ Нмс}, \)  
| | \( I_1 = 9 \text{ кгм}, \ m_2 = 16 \text{ кг}, \ m_3 = 34 \text{ кг}, \)  
| | \( m_4 = 26 \text{ кг}, \ R_1 = 36 \text{ см}, \ r_1 = 25 \text{ см}, \)  
| | \( R_3 = 26 \text{ см}, \ R_4 = 20 \text{ см}, \ r_4 = 12 \text{ см}, \ i_4 = 15 \text{ см}. \) |

*1В некоторых вариантах содержатся не все элементы.
Задача D31.5.  
\[ M_D = M_0 - k \omega_3, \quad n_z = -\mu \omega_4, \]
\[ M_0 = 9 \text{Нм}, \quad k = 11 \text{Нмс}, \]
\[ \varphi_{1,0} = 1.3, \quad n_z = 0.0.1, \]
\[ \mu = 12 \text{Нмс}, \quad I_1 = 6 \text{кгм}^2, \]
\[ m_2 = 16 \text{ кг}, \quad m_3 = 34 \text{ кг}, \quad m_4 = 26 \text{ кг}, \]
\[ m_5 = 3 \text{ кг}, \quad R_1 = 34 \text{ см}, \quad r_1 = 23 \text{ см}, \]
\[ R_2 = 24 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 15 \text{ см}. \]

Задача D31.6.  
\[ M_D = M_0 - k \omega_3, \quad n_z = -\mu \omega_4, \]
\[ M_0 = 10 \text{Нм}, \quad k = 14 \text{ Нмс}, \]
\[ \varphi_{1,0} = 1.4, \quad n_z = 0.0.4, \]
\[ \mu = 11 \text{Нмс}, \quad I_1 = 7 \text{кгм}^2, \]
\[ m_2 = 17 \text{ кг}, \quad m_3 = 35 \text{ кг}, m_4 = 27 \text{ кг}, \]
\[ m_5 = 4 \text{ кг}, \quad R_1 = 37 \text{ см}, \quad r_1 = 26 \text{ см}, \]
\[ R_3 = 27 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 16 \text{ см}, \]
\[ r_5 = 10 \text{ см}. \]

Задача D31.7.  
\[ M_D = M_0 - k \omega_3, \quad n_z = -\mu \omega_4, \]
\[ F_n = -\nu v_5, \quad \varphi_{1,0} = 1.3, \quad n_z = 0.0.3, \]
\[ M_0 = 9 \text{ Нм}, \quad k = 13 \text{ Нмс}, \]
\[ \nu = 8 \text{kHс/м}, \quad \mu = 13 \text{ Нмс}, \]
\[ I_1 = 6 \text{кгм}^2, \quad m_2 = 16 \text{ кг}, \quad m_3 = 34 \text{ кг}, \]
\[ m_4 = 26 \text{ кг}, \quad R_1 = 36 \text{ см}, \quad r_1 = 25 \text{ см}, \]
\[ R_3 = 26 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 15 \text{ см}. \]

Задача D31.8.  
\[ M_D = M_0 - k \omega_3, \quad n_z = -\mu \omega_4, \]
\[ M_0 = 10 \text{ Нм}, \quad k = 15 \text{ Нмс}, \]
\[ \varphi_{1,0} = 1.4, \quad n_z = 0.5, \]
\[ \mu = 11 \text{ Нмс}, \quad I_1 = 7 \text{кгм}^2, \]
\[ m_2 = 17 \text{ кг}, \quad m_3 = 35 \text{ кг}, m_4 = 27 \text{ кг}, \]
\[ m_5 = 4 \text{ кг}, \quad R_1 = 38 \text{ см}, \quad r_1 = 27 \text{ см}, \]
\[ R_3 = 28 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 16 \text{ см}, \]
\[ r_5 = 10 \text{ см}. \]

Задача D31.9.  
\[ M_D = M_0 - k \omega_3, \quad n_z = -\mu \omega_4, \]
\[ F_n = -\nu v_5, \quad \varphi_{1,0} = 1.4, \quad n_z = 0.2, \]
\[ M_0 = 12 \text{ Нм}, \quad k = 12 \text{ Нмс}, \]
\[ \nu = 25 \text{kHс/м}, \quad \mu = 12 \text{ Нмс}, \]
\[ I_1 = 15 \text{кгм}^2, \quad m_2 = 17 \text{ кг}, \quad m_3 = 35 \text{ кг}, \]
\[ m_4 = 27 \text{ кг}, \quad R_1 = 35 \text{ см}, \quad r_1 = 24 \text{ см}, \]
\[ R_3 = 25 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 16 \text{ см}. \]
Задача D31.10.

\[ M_{D_1} = M_0 - k\omega_3, \quad M_{n_z} = -\mu\omega_4, \]
\[ F_{n_x} = -\nu v_{5_x}, \quad \varphi_{1,0} = 1.5, \quad \omega_{1_x,0} = 0.41, \]
\[ M_0 = 12 \text{ Нм}, \quad k = 14 \text{ Нм}, \]
\[ \nu = 35 \text{ Нс/м}, \quad \mu = 10 \text{ Нс}, \]
\[ I_1 = 13 \text{ кгм}^2, \quad m_2 = 18 \text{ кг}, \quad m_3 = 36 \text{ кг}, \]
\[ m_4 = 28 \text{ кг}, \quad R_1 = 37 \text{ см}, \quad r_1 = 26 \text{ см}, \]
\[ R_3 = 27 \text{ см}, \quad R_4 = 12 \text{ см}. \]

Задача D31.11.

\[ M_{D_1} = M_0 - k\omega_3, \quad M_{n_z} = -\mu\omega_4, \]
\[ F_{n_x} = -\nu v_{5_x}, \quad \varphi_{1,0} = 1.5, \quad \omega_{1_x,0} = 0.24, \]
\[ M_0 = 12 \text{ Нм}, \quad k = 12 \text{ Нм}, \]
\[ \nu = 20 \text{ Нс/м}, \quad \mu = 10 \text{ Нс}, \]
\[ I_1 = 13 \text{ кгм}^2, \quad m_2 = 18 \text{ кг}, \quad m_3 = 36 \text{ кг}, \]
\[ m_4 = 28 \text{ кг}, \quad R_1 = 35 \text{ см}, \quad r_1 = 24 \text{ см}, \]
\[ R_3 = 25 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 17 \text{ см}. \]

Задача D31.12.

\[ M_{D_1} = M_0 - k\omega_3, \quad M_{n_z} = -\mu\omega_4, \]
\[ M_0 = 11 \text{ Нм}, \quad k = 11 \text{ Нм}, \]
\[ \varphi_{1,0} = 1.4, \quad \omega_{1_x,0} = 0.11, \]
\[ \mu = 12 \text{ Нс}, \quad I_1 = 11 \text{ кгм}^2, \]
\[ m_2 = 17 \text{ кг}, \quad m_3 = 35 \text{ кг}, m_4 = 27 \text{ кг}, \]
\[ m_5 = 6 \text{ кг}, \quad R_1 = 34 \text{ см}, \quad r_1 = 23 \text{ см}, \]
\[ R_3 = 24 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 16 \text{ см}, \quad r_5 = 11 \text{ см}. \]

Задача D31.13.

\[ M_{D_1} = M_0 - k\omega_3, \quad M_{n_z} = -\mu\omega_4, \]
\[ F_{n_x} = -\nu v_{5_x}, \quad \varphi_{1,0} = 1.1, \quad \omega_{1_x,0} = 0.41, \]
\[ M_0 = 8 \text{ Нм}, \quad k = 14 \text{ Нм}, \]
\[ \nu = 40 \text{ Нс/м}, \quad \mu = 15 \text{ Нс}, \]
\[ I_1 = 5 \text{ кгм}^2, \quad m_2 = 14 \text{ кг}, \quad m_3 = 32 \text{ кг}, \]
\[ m_4 = 24 \text{ кг}, \quad R_1 = 37 \text{ см}, \quad r_1 = 26 \text{ см}, \]
\[ R_3 = 27 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 13 \text{ см}. \]

Задача D31.14.

\[ M_{D_1} = M_0 - k\omega_3, \quad M_{n_z} = -\mu\omega_4, \]
\[ F_{n_x} = -\nu v_{5_x}, \quad \varphi_{1,0} = 1.5, \quad \omega_{1_x,0} = 0.31, \]
\[ M_0 = 11 \text{ Нм}, \quad k = 13 \text{ Нм}, \]
\[ \nu = 35 \text{ Нс/м}, \quad \mu = 10 \text{ Нс}, \]
\[ I_1 = 8 \text{ кгм}^2, \quad m_2 = 18 \text{ кг}, \quad m_3 = 36 \text{ кг}, \]
\[ m_4 = 28 \text{ кг}, \quad R_1 = 36 \text{ см}, \quad r_1 = 25 \text{ см}, \]
\[ R_3 = 26 \text{ см}, \quad R_4 = 12 \text{ см}. \]
Задача D31.15.  
\[ M_{D_z} = M_0 - k \omega_{1z}, \quad M_{n_z} = -\mu \omega_{4z}, \]  
\[ M_0 = 13 \text{ Нм, } k = 15 \text{ Нмс,} \]  
\[ \varphi_{1,0} = 1.4, \quad \omega_{1z,0} = 0.5 \frac{1}{c}, \]  
\[ \mu = 11 \text{ Нмс, } I_1 = 19 \text{ кгм^2,} \]  
\[ m_2 = 17 \text{ кг, } m_3 = 35 \text{ кг, } m_4 = 27 \text{ кг,} \]  
\[ m_5 = 70 \text{ кг, } R_1 = 38 \text{ см, } r_1 = 27 \text{ см,} \]  
\[ R_3 = 28 \text{ см, } R_4 = 20 \text{ см, } r_4 = 12 \text{ см, } i_4 = 16 \text{ см,} \]  
\[ r_5 = 16 \text{ см.} \]

Задача D31.16.  
\[ M_{D_z} = M_0 - k \omega_{1z}, \quad M_{n_z} = -\mu \omega_{4z}, \]  
\[ M_0 = 12 \text{ Нм, } k = 15 \text{ Нмс,} \]  
\[ \varphi_{1,0} = 1.3, \quad \omega_{1z,0} = 0.5 \frac{1}{c}, \]  
\[ \mu = 12 \text{ Нмс, } I_1 = 15 \text{ кгм^2,} \]  
\[ m_2 = 16 \text{ кг, } m_3 = 34 \text{ кг, } m_4 = 26 \text{ кг,} \]  
\[ m_5 = 6 \text{ кг, } R_1 = 38 \text{ см, } r_1 = 27 \text{ см,} \]  
\[ R_3 = 28 \text{ см, } R_4 = 20 \text{ см, } r_4 = 12 \text{ см, } i_4 = 15 \text{ см,} \]  
\[ r_5 = 13 \text{ см.} \]

Задача D31.17.  
\[ M_{D_z} = M_0 - k \omega_{3z}, \quad M_{n_z} = -\mu \omega_{4z}, \]  
\[ F_{n_z} = -\nu v_{n_z}, \quad \varphi_{1,0} = 1.3, \quad \omega_{1z,0} = 0.4 \frac{1}{c}, \]  
\[ M_0 = 9 \text{ Нм, } k = 14 \text{ Нмс,} \]  
\[ \nu = 45 \text{ Нс/м, } \mu = 13 \text{ Нмс,} \]  
\[ I_1 = 6 \text{ кгм^2, } m_2 = 16 \text{ кг, } m_3 = 34 \text{ кг,} \]  
\[ m_4 = 26 \text{ кг, } R_1 = 37 \text{ см, } r_1 = 26 \text{ см,} \]  
\[ R_3 = 27 \text{ см, } R_4 = 12 \text{ см.} \]

Задача D31.18.  
\[ M_{D_z} = M_0 - k \omega_{3z}, \quad M_{n_z} = -\mu \omega_{4z}, \]  
\[ \varphi_{1,0} = 1.2, \quad \omega_{1z,0} = 0.1 \frac{1}{c}, \]  
\[ M_0 = 9 \text{ Нм, } k = 11 \text{ Нмс,} \]  
\[ \mu = 13 \text{ Нмс,} \]  
\[ I_1 = 7 \text{ кгм^2, } m_2 = 15 \text{ кг, } m_3 = 33 \text{ кг,} \]  
\[ m_4 = 25 \text{ кг, } R_1 = 34 \text{ см, } r_1 = 23 \text{ см,} \]  
\[ R_3 = 24 \text{ см, } R_4 = 20 \text{ см, } r_4 = 12 \text{ см, } i_4 = 14 \text{ см.} \]

Задача D31.19.  
\[ M_{D_z} = M_0 - k \omega_{3z}, \quad M_{n_z} = -\mu \omega_{4z}, \]  
\[ \varphi_{1,0} = 1.2, \quad \omega_{1z,0} = 0.4 \frac{1}{c}, \]  
\[ M_0 = 10 \text{ Нм, } k = 14 \text{ Нмс,} \]  
\[ \mu = 13 \text{ Нмс,} \]  
\[ I_1 = 9 \text{ кгм^2, } m_2 = 15 \text{ кг, } m_3 = 33 \text{ кг,} \]  
\[ m_4 = 25 \text{ кг, } R_1 = 37 \text{ см, } r_1 = 26 \text{ см,} \]  
\[ R_3 = 27 \text{ см, } R_4 = 20 \text{ см, } r_4 = 12 \text{ см, } i_4 = 14 \text{ см.} \]
Задача D31.20.

\[ M_{D_x} = M_0 - k \omega_3 \gamma, \quad M_{n_x} = -\mu \omega_4 \gamma, \]

\[ M_0 = 10 \text{ Нм}, \quad k = 11 \text{ Нмк}, \]

\[ \varphi_{1,0} = 1.1, \quad \omega_{1,0} = 0.1 \frac{1}{c}, \]

\[ \mu = 14 \text{ Нмк}, \quad I_1 = 7 \text{ кгм}^2, \]

\[ m_2 = 14 \text{ кг}, \quad m_3 = 32 \text{ кг}, \quad m_4 = 24 \text{ кг}, \]

\[ m_5 = 4 \text{ кг}, \quad R_1 = 34 \text{ см}, \quad r_1 = 23 \text{ см}, \]

\[ R_3 = 24 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 13 \text{ см}, \]

\[ r_5 = 13 \text{ см}. \]

Задача D31.21.

\[ M_{D_x} = M_0 - k \omega_3 \gamma, \quad M_{n_x} = -\mu \omega_4 \gamma, \]

\[ F_{n_x} = -\nu v_{5 \gamma}, \quad \varphi_{1,0} = 1.2, \quad \omega_{1,0} = 0.4 \frac{1}{c}, \]

\[ M_0 = 9 \text{ Нм}, \quad k = 14 \text{ Нмк}, \]

\[ \nu = 8 \text{kНс/м}, \quad \mu = 14 \text{ Нмк}, \]

\[ I_1 = 7 \text{ кгм}^2, \quad m_2 = 15 \text{ кг}, \quad m_3 = 33 \text{ кг}, \]

\[ m_4 = 25 \text{ кг}, \quad R_1 = 37 \text{ см}, \quad r_1 = 26 \text{ см}, \]

\[ R_3 = 27 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 14 \text{ см}. \]

Задача D31.22.

\[ M_{D_x} = M_0 - k \omega_3 \gamma, \quad M_{n_x} = -\mu \omega_4 \gamma, \]

\[ F_{n_x} = -\nu v_{5 \gamma}, \quad \varphi_{1,0} = 1.1, \quad \omega_{1,0} = 0.4 \frac{1}{c}, \]

\[ M_0 = 8 \text{ Нм}, \quad k = 14 \text{ Нмк}, \]

\[ \nu = 8 \text{kНс/м}, \quad \mu = 14 \text{ Нмк}, \]

\[ I_1 = 5 \text{ кгм}^2, \quad m_2 = 14 \text{ кг}, \quad m_3 = 32 \text{ кг}, \]

\[ m_4 = 24 \text{ кг}, \quad R_1 = 37 \text{ см}, \quad r_1 = 26 \text{ см}, \]

\[ R_3 = 27 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 13 \text{ см}. \]

Задача D31.23.

\[ M_{D_x} = M_0 - k \omega_3 \gamma, \quad M_{n_x} = -\mu \omega_4 \gamma, \]

\[ M_0 = 12 \text{ Нм}, \quad k = 12 \text{ Нмк}, \]

\[ \varphi_{1,0} = 1.5, \quad \omega_{1,0} = 0.2 \frac{1}{c}, \]

\[ \mu = 11 \text{ Нмк}, \quad I_1 = 13 \text{ кгм}^2, \]

\[ m_2 = 18 \text{ кг}, \quad m_3 = 36 \text{ кг}, m_4 = 28 \text{ кг}, \]

\[ m_5 = 7 \text{ кг}, \quad R_1 = 35 \text{ см}, \quad r_1 = 24 \text{ см}, \]

\[ R_3 = 25 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 17 \text{ см}, \]

\[ r_5 = 11 \text{ см}. \]

Задача D31.24.

\[ M_{D_x} = M_0 - k \omega_3 \gamma, \quad M_{n_x} = -\mu \omega_4 \gamma, \]

\[ F_{n_x} = -\nu v_{5 \gamma}, \quad \varphi_{1,0} = 1.5, \quad \omega_{1,0} = 0.1 \frac{1}{c}, \]

\[ M_0 = 12 \text{ Нм}, \quad k = 11 \text{ Нмк}, \]

\[ \nu = 35 \text{kНс/м}, \quad \mu = 11 \text{ Нмк}, \]

\[ I_1 = 13 \text{ кгм}^2, \quad m_2 = 18 \text{ кг}, \quad m_3 = 36 \text{ кг}, \]

\[ m_4 = 28 \text{ кг}, \quad R_1 = 34 \text{ см}, \quad r_1 = 23 \text{ см}, \]

\[ R_3 = 24 \text{ см}, \quad R_4 = 12 \text{ см}. \]
Задача D31.25.

\[ M_{D_x} = M_0 - k_0 \omega_3, \quad M_{n_z} = -\mu_0 \omega_4, \]
\[ M_0 = 13 \text{ Нм}, \quad k = 13 \text{ Нмс}, \]
\[ \varphi_{1,0} = 1.5, \quad \omega_{1,0} = 0.31, \]
\[ \mu = 10 \text{ Нмс}, \quad I_1 = 18 \text{ кгм}^2, \]
\[ m_2 = 18 \text{ кг}, \quad m_3 = 36 \text{ кг}, \quad m_4 = 28 \text{ кг}, \]
\[ m_5 = 7 \text{ кг}, \quad R_1 = 36 \text{ см}, \quad r_1 = 25 \text{ см}, \]
\[ R_3 = 26 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 17 \text{ см}. \]

Задача D31.26.

\[ M_{D_x} = M_0 - k_0 \omega_3, \quad M_{n_z} = -\mu_0 \omega_4, \]
\[ F_{n_x} = -\nu v_{0_x}, \quad \varphi_{1,0} = 1.5, \quad \omega_{1,0} = 0.41, \]
\[ M_0 = 13 \text{ Нм}, \quad k = 14 \text{ Нмс}, \]
\[ \nu = 20 \text{ Нс/м}, \quad \mu = 10 \text{ Нмс}, \]
\[ I_1 = 18 \text{ кгм}^2, \quad m_2 = 18 \text{ кг}, \quad m_3 = 36 \text{ кг}, \]
\[ m_4 = 28 \text{ кг}, \quad R_1 = 37 \text{ см}, \quad r_1 = 26 \text{ см}, \]
\[ R_3 = 27 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 17 \text{ см}. \]

Задача D31.27.

\[ M_{D_x} = M_0 - k_0 \omega_3, \quad M_{n_z} = -\mu_0 \omega_4, \]
\[ M_0 = 7 \text{ Нм}, \quad k = 15 \text{ Нмс}, \]
\[ \varphi_{1,0} = 1.1, \quad \omega_{1,0} = 0.51, \]
\[ \mu = 15 \text{ Нмс}, \quad I_1 = 4 \text{ кгм}^2, \]
\[ m_2 = 14 \text{ кг}, \quad m_3 = 32 \text{ кг}, m_4 = 24 \text{ кг}, \]
\[ m_5 = 2 \text{ кг}, \quad R_1 = 38 \text{ см}, \quad r_1 = 27 \text{ см}, \]
\[ R_3 = 28 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 13 \text{ см}, \]
\[ r_5 = 10 \text{ см}. \]

Задача D31.28.

\[ M_{D_x} = M_0 - k_0 \omega_3, \quad M_{n_z} = -\mu_0 \omega_4, \]
\[ F_{n_x} = -\nu v_{0_x}, \quad \varphi_{1,0} = 1.3, \quad \omega_{1,0} = 0.21, \]
\[ M_0 = 12 \text{ Нм}, \quad k = 12 \text{ Нмс}, \]
\[ \nu = 45 \text{ Нс/м}, \quad \mu = 13 \text{ Нмс}, \]
\[ I_1 = 15 \text{ кгм}^2, \quad m_2 = 16 \text{ кг}, \quad m_3 = 34 \text{ кг}, \]
\[ m_4 = 26 \text{ кг}, \quad R_1 = 35 \text{ см}, \quad r_1 = 24 \text{ см}, \]
\[ R_3 = 25 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 15 \text{ см}. \]

Задача D31.29.

\[ M_{D_x} = M_0 - k_0 \omega_3, \quad M_{n_z} = -\mu_0 \omega_4, \]
\[ \varphi_{1,0} = 1.4, \quad \omega_{1,0} = 0.31, \]
\[ M_0 = 12 \text{ Нм}, \quad k = 13 \text{ Нмс}, \]
\[ \mu = 12 \text{ Нмс}, \]
\[ I_1 = 15 \text{ кгм}^2, \quad m_2 = 17 \text{ кг}, \quad m_3 = 35 \text{ кг}, \]
\[ m_4 = 27 \text{ кг}, \quad R_1 = 36 \text{ см}, \quad r_1 = 25 \text{ см}, \]
\[ R_3 = 26 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 16 \text{ см}. \]
Задача D31.30.

\[ M_{D_z} = M_0 - k\omega_3, \quad M_{n_z} = -\mu\omega_4, \]

\( M_0 = 13\text{Нм}, \quad k = 14\text{Нмс}, \)

\( \phi_{1,0} = 1.5, \quad \omega_{1,z,0} = 0.41, \)

\( \mu = 10\text{Нмс}, \quad I_1 = 18\text{ кгм}^2, \)

\( m_2 = 18\text{ кг}, \quad m_3 = 36\text{ кг}, \quad m_4 = 28\text{ кг}, \)

\( m_5 = 7\text{ кг}, \quad R_1 = 37\text{ см}, \quad r_1 = 26\text{ см}, \)

\( R_3 = 27\text{ см}, \quad R_4 = 20\text{ см}, \quad r_4 = 12\text{ см}, \quad i_4 = 17\text{ см}. \)

Задача D31.31.

\[ M_{D_z} = M_0 - k\omega_3, \quad M_{n_z} = -\mu\omega_4, \]

\[ F_n = -\nu v_5, \quad \phi_{1,0} = 1.5, \quad \omega_{1,z,0} = 0.41, \]

\( M_0 = 13\text{ Нм}, \quad k = 14\text{ Нмс}, \)

\( \nu = 10\text{Нс/м}, \quad \mu = 11\text{ Нмс}, \)

\( I_1 = 18\text{ кгм}^2, \quad m_2 = 18\text{ кг}, \quad m_3 = 36\text{ кг}, \)

\( m_4 = 28\text{ кг}, \quad R_1 = 37\text{ см}, \quad r_1 = 26\text{ см}, \)

\( R_3 = 27\text{ см}, \quad R_4 = 20\text{ см}, \quad r_4 = 12\text{ см}, \quad i_4 = 17\text{ см}. \)

Задача D31.32.

\[ M_{D_z} = M_0 - k\omega_3, \quad M_{n_z} = -\mu\omega_4, \]

\[ F_n = -\nu v_5, \quad \phi_{1,0} = 1.5, \quad \omega_{1,z,0} = 0.41, \]

\( M_0 = 13\text{ Нм}, \quad k = 14\text{ Нмс}, \)

\( \nu = 10\text{Нс/м}, \quad \mu = 11\text{ Нмс}, \)

\( I_1 = 18\text{ кгм}^2, \quad m_2 = 18\text{ кг}, \quad m_3 = 36\text{ кг}, \)

\( m_4 = 28\text{ кг}, \quad R_1 = 37\text{ см}, \quad r_1 = 26\text{ см}, \)

\( R_3 = 27\text{ см}, \quad R_4 = 20\text{ см}, \quad r_4 = 12\text{ см}, \quad i_4 = 17\text{ см}. \)
<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>Q</th>
<th>c</th>
<th>B2</th>
<th>B4</th>
<th>B5</th>
<th>QF</th>
<th>QM</th>
<th>QD</th>
<th>QT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-150.156</td>
<td>5.533</td>
<td>1.31</td>
<td>6.14</td>
<td>0.00</td>
<td>0.00</td>
<td>128.95</td>
<td>-27.70</td>
<td>6.50</td>
<td>0.00</td>
</tr>
<tr>
<td>2</td>
<td>-79.763</td>
<td>5.038</td>
<td>1.01</td>
<td>8.98</td>
<td>0.00</td>
<td>0.00</td>
<td>10.57</td>
<td>-47.71</td>
<td>21.48</td>
<td>0.00</td>
</tr>
<tr>
<td>3</td>
<td>-86.552</td>
<td>4.758</td>
<td>0.95</td>
<td>14.42</td>
<td>0.00</td>
<td>0.00</td>
<td>16.11</td>
<td>-50.34</td>
<td>20.11</td>
<td>0.00</td>
</tr>
<tr>
<td>4</td>
<td>-4.375</td>
<td>-0.339</td>
<td>1.00</td>
<td>0.99</td>
<td>0.00</td>
<td>-8.70</td>
<td>-2.04</td>
<td>6.37</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>-8.180</td>
<td>-0.734</td>
<td>0.85</td>
<td>2.15</td>
<td>0.44</td>
<td>0.00</td>
<td>-4.09</td>
<td>-14.96</td>
<td>10.87</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>-35.901</td>
<td>-2.585</td>
<td>1.15</td>
<td>3.24</td>
<td>0.28</td>
<td>0.00</td>
<td>-20.06</td>
<td>-24.22</td>
<td>8.38</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>-97.551</td>
<td>-7.514</td>
<td>1.00</td>
<td>4.16</td>
<td>0.00</td>
<td>0.00</td>
<td>-61.90</td>
<td>-15.72</td>
<td>19.94</td>
<td>0.00</td>
</tr>
<tr>
<td>8</td>
<td>-34.342</td>
<td>-3.529</td>
<td>1.24</td>
<td>3.50</td>
<td>0.30</td>
<td>0.00</td>
<td>-0.80</td>
<td>-27.39</td>
<td>-6.15</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>-46.955</td>
<td>-1.708</td>
<td>0.98</td>
<td>9.72</td>
<td>0.00</td>
<td>0.00</td>
<td>-4.47</td>
<td>-20.98</td>
<td>-21.50</td>
<td>0.00</td>
</tr>
<tr>
<td>10</td>
<td>-16.522</td>
<td>-0.850</td>
<td>1.22</td>
<td>2.84</td>
<td>0.00</td>
<td>0.00</td>
<td>-3.77</td>
<td>-18.68</td>
<td>5.93</td>
<td>0.00</td>
</tr>
<tr>
<td>11</td>
<td>-9.482</td>
<td>-0.284</td>
<td>1.04</td>
<td>17.36</td>
<td>0.00</td>
<td>-3.67</td>
<td>-17.91</td>
<td>12.10</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>-14.583</td>
<td>0.528</td>
<td>0.90</td>
<td>0.91</td>
<td>0.04</td>
<td>0.00</td>
<td>-1.54</td>
<td>13.38</td>
<td>-4.00</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>-24.311</td>
<td>-2.591</td>
<td>0.95</td>
<td>1.90</td>
<td>0.00</td>
<td>0.00</td>
<td>-2.39</td>
<td>-22.37</td>
<td>0.45</td>
<td>0.00</td>
</tr>
<tr>
<td>14</td>
<td>-38.275</td>
<td>-2.723</td>
<td>1.13</td>
<td>2.63</td>
<td>0.00</td>
<td>0.00</td>
<td>-2.61</td>
<td>-12.96</td>
<td>-22.71</td>
<td>0.00</td>
</tr>
<tr>
<td>15</td>
<td>1.253</td>
<td>1.24</td>
<td>3.50</td>
<td>5.10</td>
<td>0.00</td>
<td>0.00</td>
<td>-27.04</td>
<td>5.50</td>
<td>60.90</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>-10.941</td>
<td>-0.518</td>
<td>1.17</td>
<td>2.96</td>
<td>0.46</td>
<td>0.00</td>
<td>-28.20</td>
<td>4.50</td>
<td>12.76</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>-50.033</td>
<td>4.261</td>
<td>1.08</td>
<td>2.64</td>
<td>0.00</td>
<td>0.00</td>
<td>-4.52</td>
<td>-22.66</td>
<td>-22.85</td>
<td>0.00</td>
</tr>
<tr>
<td>18</td>
<td>-14.583</td>
<td>-1.600</td>
<td>0.79</td>
<td>0.77</td>
<td>0.00</td>
<td>0.00</td>
<td>-0.09</td>
<td>10.54</td>
<td>-25.04</td>
<td>0.00</td>
</tr>
<tr>
<td>19</td>
<td>-52.975</td>
<td>4.589</td>
<td>1.01</td>
<td>0.98</td>
<td>0.00</td>
<td>0.00</td>
<td>-0.45</td>
<td>-24.22</td>
<td>-28.30</td>
<td>0.00</td>
</tr>
<tr>
<td>20</td>
<td>0.176</td>
<td>0.741</td>
<td>1.49</td>
<td>0.22</td>
<td>0.00</td>
<td>0.00</td>
<td>-4.08</td>
<td>8.90</td>
<td>-6.70</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>-7.755</td>
<td>-0.734</td>
<td>1.01</td>
<td>0.63</td>
<td>0.00</td>
<td>0.00</td>
<td>-7.52</td>
<td>-2.06</td>
<td>1.82</td>
<td>0.00</td>
</tr>
<tr>
<td>22</td>
<td>-9.037</td>
<td>9.037</td>
<td>0.95</td>
<td>3.53</td>
<td>0.00</td>
<td>0.00</td>
<td>-76.36</td>
<td>-20.88</td>
<td>0.45</td>
<td>0.00</td>
</tr>
<tr>
<td>23</td>
<td>13.876</td>
<td>0.795</td>
<td>1.04</td>
<td>1.17</td>
<td>0.05</td>
<td>0.00</td>
<td>1.54</td>
<td>12.10</td>
<td>4.93</td>
<td>0.00</td>
</tr>
<tr>
<td>24</td>
<td>10.035</td>
<td>0.550</td>
<td>0.95</td>
<td>2.22</td>
<td>0.00</td>
<td>0.00</td>
<td>-0.74</td>
<td>-4.02</td>
<td>14.79</td>
<td>0.00</td>
</tr>
<tr>
<td>25</td>
<td>-26.641</td>
<td>1.307</td>
<td>1.13</td>
<td>3.51</td>
<td>1.22</td>
<td>0.00</td>
<td>-0.07</td>
<td>-25.48</td>
<td>-1.10</td>
<td>0.00</td>
</tr>
<tr>
<td>26</td>
<td>1.889</td>
<td>1.22</td>
<td>20.38</td>
<td>0.00</td>
<td>0.00</td>
<td>8.61</td>
<td>42.04</td>
<td>28.33</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>-42.225</td>
<td>-6.298</td>
<td>1.02</td>
<td>0.74</td>
<td>0.00</td>
<td>0.00</td>
<td>-2.81</td>
<td>23.31</td>
<td>-16.10</td>
<td>0.00</td>
</tr>
<tr>
<td>28</td>
<td>4.416</td>
<td>7.971</td>
<td>0.431</td>
<td>0.92</td>
<td>0.54</td>
<td>0.00</td>
<td>-0.27</td>
<td>-1.36</td>
<td>9.60</td>
<td>0.00</td>
</tr>
<tr>
<td>29</td>
<td>-35.463</td>
<td>-2.046</td>
<td>1.06</td>
<td>0.66</td>
<td>0.00</td>
<td>0.00</td>
<td>-0.06</td>
<td>-24.09</td>
<td>-11.31</td>
<td>0.00</td>
</tr>
<tr>
<td>30</td>
<td>-17.332</td>
<td>-0.650</td>
<td>1.22</td>
<td>3.80</td>
<td>1.31</td>
<td>0.00</td>
<td>-18.68</td>
<td>28.33</td>
<td>29.68</td>
<td>0.00</td>
</tr>
<tr>
<td>31</td>
<td>-31.642</td>
<td>-1.380</td>
<td>1.22</td>
<td>1.27</td>
<td>0.00</td>
<td>0.00</td>
<td>-2.89</td>
<td>-28.33</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>-31.642</td>
<td>-1.380</td>
<td>1.22</td>
<td>1.27</td>
<td>0.00</td>
<td>0.00</td>
<td>-2.89</td>
<td>-28.33</td>
<td>0.00</td>
<td></td>
</tr>
</tbody>
</table>

| D3I файл | o31d2A |